MCO 203

HOSPITAL TECHNICAL MEMORANDUM

FACSIMILE TELEGRAPHY: POSSIBLE APPLICATIONS IN DISTRICT GENERAL HOSPITALS

18

MINISTRY OF HEALTH : LONDON : HER MAJESTY'S STATIONERY OFFICE
JUNE 1967 PRICE 2s. 6d. NET

Facsimile Telegraphy: Possible Applications in District General Hospitals

CONTENTS

		Paragraph
I	**Introduction**	1
	Scope of the study	7
	Results of the study	10
II	**Equipment and Systems available**	11
	Equipment for prepared document transmission	12
	Equipment for manuscript communication	15
III	**Scope, conduct and evaluation of studies**	18
	Internal document movement and telephone traffic in hospitals of the district general hospital type	18
	Document traffic	19
	Telephone traffic	23
IV	**Pathology report transmission by F/T**	25
	Scope and conduct of trials	25
	Aims of trials	26
	Results of trials	27
	Factors affecting the choice of F/T for pathology report transmission in district general hospitals	28
	Conclusions as to suitability	33

Appendices

		Page No.
A	The principal internal document movements in two hospitals of the district general hospital type and considerations affecting the introduction of F/T transmission in place of existing methods	8
B	Comparative costs of F/T transmission and messenger delivery of single-sheet documents most frequently transmitted, between 20 wards and departments in a district general hospital of 600 beds	14
C	Comparative costs of F/T transmission and messenger delivery of pathology reports between the laboratory and 20 wards in a district general hospital of 600 beds	15

I. Introduction

1. Facsimile telegraphy (F/T) is electronic equipment designed to transmit and receive the contents of documents in facsimile over public telephone system or private line for any distance. Handwritten, typed or printed documents, charts and photographs can be transmitted, although colour is not reproduced and facsimile copies are in black and white. Documents can be made available to one or any number of locations where the equipment is installed within a few minutes of their compilation, transmission time depending on the type of equipment used and the size of the documents. An exception to this is a model for sending handwritten messages, in which the writing of the message and transmission occurs virtually simultaneously. Although this model differs from the others studied because transmission is achieved by an electronically linked pantograph system and not by a photoelectric scanning device—the normal mode of operation for F/T equipment—it was thought proper to include it in the study because it provides comparable facilities. Details of this and the other models currently available appear in paragraphs 11 to 17 of this report.

2. This method of document transmission is obviously faster than the messenger and postal services used at present by hospital authorities, providing the volume to be transmitted is not sufficient to make transmission time a significant factor. On the other hand, because document transmission in hospitals is often associated with the movement of patients, stores or other articles, F/T equipment could not replace the present services entirely so that savings on these services large enough to offset the comparatively high capital cost of any equipment installed is unlikely to be collectable in practice. Furthermore, the movement of documents in hospitals is seldom so urgent that the delays inherent in a properly organised messenger service are unacceptable. Even when they are, it may not be necessary for the recipient to receive a facsimile copy immediately and the need may be adequately met by notifying the contents of a document by telephone and then forwarding it by the messenger service in the usual way.

3. Movement of the most commonly transmitted documents between departments, wards and offices in hospitals is usually either divergent or convergent, the main focal points being the wards, the out-patients and accident and emergency departments, the pharmacy, the pathology laboratory, the physical medicine and X-ray departments, and the main administrative offices. This movement pattern contributes significantly to the cost of messenger services provided in hospitals and would similarly affect the cost of comprehensive F/T transmission because of the need to provide equipment at all the locations involved.

4. F/T could also be used to transmit any of the large number of messages in hospitals for which the telephone is used at present, although obviously impracticable for lengthy or interlocutory calls. As a substitute for the telephone F/T would be more expensive and rather slower but would provide facsimile copies of messages for the recipients.

5. It is also understood that F/T equipment is now available which could transmit X-ray films, medical photographs and documents in chart form and provide facsimile copies of good quality. Equipment for this purpose is appreciably more expensive than that designed for document and message traffic described in paragraphs 11 to 17 of this report, so that even if circumstances existed in which prompter delivery of such records would be advantageous, the cost would be much greater than that for a closed circuit television chain, now available for as little as £250. In the circumstances no evaluation of this type of application was made during the study which was restricted to a consideration of the usefulness of F/T for document and message traffic.

6. Although to date only a very few hospital authorities have considered the possibility of using F/T equipment for document and message transmission, as the facilities it provides become better known, interest in its possible applications in hospitals can be expected to increase. The Central O & M Unit therefore, undertook this study to provide guidance on the suitability of F/T as a communication aid in district general hospitals and the following terms of reference were adopted:

(1) to examine the extent to which F/T may be of value as a means of communication in the hospital service;

(2) to provide general guidance on any desirable applications for F/T in a hospital of the district general type;

(3) to provide details of the equipment currently available from manufacturers.

Scope of the study

7. To augment available data, studies were made in two hospitals planned for development as district general hospitals of internal document transmission and telephone traffic. The hospitals visited were selected because they appeared to provide the variety and level of activitiy which may be expected in a hospital of this type. The assistance given during the study by hospital authorities, by their officers and by manufacturers is gratefully acknowledged.

8. This report describes the F/T equipment currently available from manufacturers, gives details of the data obtained from the two hospitals visited, and the conclusions which appear to emerge. It also includes information extracted from a report* on two trials undertaken in association with the Camberwell Hospitals Management Committee and the King's College Hospital Board of Governors to determine the extent

* The full report is published in Hospital Technical Memorandum No. 19, Facsimile Telegraphy: The Transmission of Pathology Reports within a Hospital—A Case Study (H.M.S.O., price 3*s.* 6*d.* net).

of the advantages accruing from the use of F/T equipment for the transmission of pathology reports between laboratory and wards. Although this study is primarily concerned with the needs of district general hospitals, the same considerations and therefore the conclusions reached can generally be expected to apply to similar internal document movement and telephone traffic in other types of hospitals.

9. External document movement and telephone traffic between hospitals, between Hospital Management Committees and Regional Hospital Boards, and between hospitals and Local Health Authorities, were not studied. But the study has provided evidence that there may be desirable applications in the field of external communications where written information has to be transmitted with some degree of urgency. In such cases the use of F/T might well provide significant savings in time over such existing delivery arrangements as post or hospital vehicle. Three possible applications in this field which will be examined in later studies are as follows:

(1) The movement of pathology reports between hospitals in Groups with centralised laboratory facilities.

(2) The transmission of data between Hospital Management Committee and Regional Hospital Board Data Processing Centres.

(3) The notification of transport requests by hospitals to Local Health Authority ambulance centres.

The claims of teleprinter equipment will also need to be considered in relation to (2) and (3) although probably not in the case of (1) because present practice requires a pathologist's signature on each report issued. The trials made of F/T for pathology report transmission within hospitals have indicated that a much better case may exist generally for using this equipment for transmitting reports between hospitals in Groups with centralised laboratory services. The main reason for this is that external document movement between hospitals normally takes much longer than internal movement because deliveries are usually considerably less frequent and the distances involved much greater. In these circumstances the possibility that significant benefits would accrue to patients because reports could be acted upon sooner would be greater although, as local circumstances could always be expected to differ, each case would involve separate consideration to determine whether this criterion would be satisfied by the introduction of F/T.

Results of the study

10. The main conclusions may be briefly summarised as follows:

(1) There are a number of documents in common use in hospitals which consist of a single sheet of paper and are moved between wards and/or departments either singly or in small batches. These could be transmitted by F/T but to do so would in all cases cost substantially more than delivery by messenger service and only in the case of pathology report transmission between laboratory and wards would the use of this equipment have any appreciable advantages. On the evidence of trials made these advantages are probably too tenuous and uncertain to justify the additional expense. It would obviously be uneconomical and impractical to transmit documents consisting of batches of attached papers, such as patients' case notes, in this way.

(2) The telephone is normally used for internal message traffic in hospitals, particularly when there is a need for urgent communication between wards and/or departments. Compared with the telephone, F/T costs appreciably more, it is slower and the sender has no immediate way of knowing whether the intended recipient is even present at the receiver to accept the message. The latter two disadvantages would be particularly significant if F/T were used for urgent messages concerned with emergencies affecting patients. The study revealed no applications in which F/T could be substituted with advantage for the internal telephone.

(As the study was limited to identifying any internal communication channels in hospitals for which F/T equipment could be used with advantage and because it showed that existing methods were to be preferred in every case, other ways of providing these facilities, such as teleprinter or radio telephony, were not considered. The possible uses for teleprinter equipment in the Hospital Service will be the subject of a separate study.)

II. Equipment and systems available

11. At the present time there are only two suppliers of F/T equipment in the United Kingdom, although it is known that two other British electronics firms have associated companies in the U.S.A. making this type of equipment. In both cases the equipment could be adapted for use here but it is understood there are no plans to do so at present. A West German firm also marketed F/T equipment in the United Kingdom until recently when its agency arrangements lapsed. It is understood to be attempting to negotiate fresh arrangements with another British electronics firm at the present time. The equipment currently available is of two types; one designed for the transmission of prepared documents and the other for the transmission of manuscript communication written directly on to a roll of continuous stationery in the transmitter. The principal features of the two types are described below:

Equipment for prepared document transmission

12. This type of equipment is available from one of the two suppliers traced. It will transmit the whole or any selected part of prepared documents or drawings in

typed, printed or manuscript form. The legibility of the facsimile copies produced is satisfactory at least down to 8-point type size, and it is claimed they are usable immediately and will not fade. Switching can be provided to enable a receiver to be fed by any one of a number of transmitters or to enable a transmitter to feed a number of receivers either singly, simultaneously or in any required groupings. Models with transmission times varying between 15 and 27 seconds per inch of copy are available with a maximum copy depth of 13¾ in. and width of 8⅜ in. At the highest speed available, therefore, transmission of a foolscap size document would take 3 minutes 26¼ seconds and at the lowest speed 9 minutes 10 seconds. It is understood the highest speed equipment can only be used with private lines of not more than about five miles in length. Above this distance and on all G.P.O. public lines satisfactory facsimiles cannot normally be produced unless the transmission speed is restricted to 22.5 seconds per inch of copy. Within the periphery of a hospital the internal telephone lines could be used, although if this resulted in significant interference with the normal telephone traffic it would probably be preferable to install additional lines for the F/T transmission.

13. A document to be transmitted is wrapped around a drum in the transmitter. During transmission the drum is rotated and a photo-electric scanning device is slowly traversed in a direction parallel to the drum's axis so that the whole document is scanned in the form of a close spiral. The movements of the roll of special recording paper and the writing head in the receiver are synchronised with the movements of the scanning unit and drum respectively in the transmitter. This causes the writing head to which the modulated signals from the transmitter are fed, to traverse the paper in a series of adjacent parallel lines, each corresponding to a scanning line around the transmitter drum, and to build up a facsimile image of the original document. Transmission is always initiated and controlled from the transmitter and there is no need for the receiver to be staffed. Once switched on the receiver is completely automatic and sends a " satisfactory reception " signal back to the transmitter when transmission is completed before reverting to standby. An audible " end of message " alarm is also provided at both transmitter and receiver to indicate when transmission has been completed.

14. The following table shows the current prices quoted for this type of equipment:

Item	*Purchase price* (£)	*Annual rental** (£)
Transmitter	898	240
Receiver	756	210
Paper rolls for receiver (200 ft. by 9 in. each) per dozen	18	—

* Minimum term of five years.

The F/T equipment previously available from the West German firm provided similar facilities to those described above at comparable prices.

Equipment for manuscript communication

15. This type of equipment is available from the other of the two suppliers traced. It can also be operated over public, private or internal telephone lines. Transmission is initiated from the transmitter and the receiver need not be staffed during transmission. Switching can be provided to enable a transmitter to feed a number of receivers either singly, simultaneously, or in any required groupings and for a receiver to be fed by any one of a number of transmitters. A " satisfactory reception " signal device is also available if required.

16. The transmitter provided has a writing area 5 in. wide by 3½ in. deep, but because this is actually a section of a roll of continuous stationery which can be advanced as required, messages of virtually any length can be sent. A special stylus is supplied to write the messages or to add the variable information if the stationery is preprinted. Only marks made by the stylus are transmitted so that if preprinted stationery is in use in the transmitter, identical stationery must be used in the receiver and, in this respect, this equipment differs from the other types described in this report which transmit all marks including preprinting. The action of writing on the paper in the transmitter with the stylus causes frequency modulated signals to be sent to the receiver where they are interpreted and made to operate a " slave " stylus which traces a facsimile copy on the paper by following exactly the movements of the transmitter stylus. The " slave " stylus follows the movements of the transmitter stylus without any perceptible delay and for all practical purposes transmission can be considered to take place instantaneously. When the writing area in the transmitter is used up the paper is advanced by pressing the appropriate release button and this also causes the paper in the receiver to be advanced to exactly the same extent. The following table shows the current prices quoted by the suppliers of this equipment:

Item	*Purchase price* (£)	*Annual rental** (£)
Transmitter	430	86
Receiver	535	107
Combined transmitter and receiver	800	160
Paper rolls for transmitter and receiver (200 ft. by 6 in. each) per dozen ..	6	—

* Minimum term of seven years.

17. The West German firm referred to in paragraph 11 also marketed equipment for the transmission of short handwritten messages. In this case each message was limited to a 6 in. by 1 in. section of a roll of plain or preprinted paper in the transmitter. Any type of pen or pencil could be used to mark the paper. Transmission was effected by advancing the section of paper on which the message had been written through a reading head incorporating an optical scanning system and photoelectric cell. The modulated signals produced were fed to a writing head in the receiver which produced a facsimile copy on an identical paper roll whose

movement was synchronised with that of the paper in the transmitter. The transmission time for each message was 48 seconds. The current prices of this equipment are not yet available but, having regard to previously quoted figures, they are likely to be in the region of £550 for a transmitter and £375 for a receiver.

III. Scope, conduct and evaluation of studies

Internal document movement and telephone traffic in hospitals of the district general hospital type

18. To function effectively a hospital requires a comprehensive network of communication channels between wards and/or departments. The initial step in this study, therefore, was to survey the communication needs of district general hospitals and to identify those channels for which F/T equipment could possibly be used. The next stage was to arrange field studies designed to identify any channels for which F/T equipment could be used with advantage when compared, not only with the existing method of transmission, but with any others that are available. As has already been stated in paragraph 7 studies were made in two hospitals planned for development as district general hospitals and the following data were collected:

Documents

(1) the type, number and need for all internally transmitted documents;

(2) their source and destination;

(3) the existing movement arrangements and how far these meet the requirements;

(4) details of simultaneous movements of either equipment, stores, other articles or patients;

Telephone calls

(5) the extent and purpose of regular telephone traffic;

(6) its source and destination;

(7) the extent to which the telephone met the communication needs for which it was used.

Document traffic

19. Analyses of the document traffic in the two hospitals visited showed that most of the larger movements of documents of the single-sheet type referred to in paragraph 10 (1) were provided by request/report forms for pathology, x-ray and physiotherapy, prescription cards, admission forms, transport requests and prescriptions for patients' appliances. All these forms are concerned with the documentation of patients and in most cases the forms used were eventually filed in the case notes of the patients concerned. Case notes were also moved in substantial numbers but because they comprise a folder normally containing an accumulation of papers, F/T transmission would generally be impracticable although, in any case, urgent movement was not normally required. The only other documents of the single-sheet type moved in substantial numbers were works and provisions requisitions, ward diet summaries and clock cards. Movement of all the others in use was less than 20 per day and in none of these cases would the use of F/T transmission have provided any advantages over the existing arrangements for messenger delivery.

20. Attention was therefore concentrated on the 11 documents itemised in the previous paragraph and the information collected about existing transmission arrangements in the hospitals visited—in all cases they were conveyed by messenger—and the considerations affecting the introduction of F/T equipment in place of these arrangements are set out in Appendix A to this report. In every case there was a valid reason for the transfer of the information contained in the documents and a need to provide it in recorded form.

21. Only in the case of the return of pathology reports from the laboratory to the wards did it appear at all possible that F/T transmission would provide advantages commensurate with the additional cost involved. As has already been mentioned in sub-paragraph 10 (1), two field trials carried out to determine the extent of these advantages showed they are probably too tenuous and uncertain to justify the additional cost of F/T transmission. A brief outline of the trials and the results obtained appear in paragraphs 25 to 33 of this report.

22. In all the other cases of document movement studied, only insignificant non-financial advantages, if any, were revealed and as the cost of F/T transmission was invariably much greater than messenger delivery its use would be uneconomical. This is exemplified in Appendix B which shows the comparative costs of F/T transmission and messenger delivery for the eight single-sheet documents shown by the field studies to be most frequently transmitted from wards to departments. This shows that for this application F/T transmission is nearly four times as expensive as messenger delivery and this costing makes no allowance for the following two factors which make F/T transmission even less attractive economically:

(1) In practice a messenger service could be expected to provide a comprehensive delivery and collection service for wards and departments, and not one restricted to conveying only the eight documents mentioned. This could be done without increasing the cost of the messenger service to any significant extent but F/T equipment could provide no comparable additional facilities.

(2) If a F/T network on the lines indicated were introduced only a part of the cost of the messenger service would be saved because of the continuing need to provide for the movement of other types of document between wards and departments, as well as the movement of specimens, stores, equipment and other articles.

Telephone traffic

23. Although considerable use was made of the internal telephone system in the hospitals visited it was not possible to identify any regular traffic which could with advantage be transferred to F/T equipment. Telephone traffic generally followed a similarly divergent and convergent pattern to that already identified for the movement of documents. The four main purposes of telephone calls were as follows:

(1) to provide or obtain information;
(2) to issue or receive instructions;
(3) to summon assistance required in the case of emergencies affecting patients;
(4) to requisition services or items of stores or equipment, usually when there was an element of urgency and the use of written requisitions would have produced an unacceptable delay.

In all cases the use of F/T transmission in place of the internal telephone would be slower and cost considerably more. Furthermore, calls in the first two categories are generally interlocutory and therefore unsuitable for F/T transmission, and delays could occur which might be particularly serious in relation to categories (3) and (4) because the originator of a message transmitted by F/T does not know whether the intended recipient is present at the time.

24. As the studies showed that F/T equipment could not be substituted with advantage even for the existing internal communication channels at present provided by messenger and telephone in the hospitals visited, it was obviously pointless to go on to compare its usefulness with other forms of document and message transmission equipment available, such as closed circuit television, teleprinter or radio telephony.

IV. Pathology report transmission by F/T

Scope and conduct of trials

25. Both trials took place between two wards and the pathology laboratory responsible for testing and reporting on their specimens and lasted for consecutive periods of 21 and 27 days respectively. In one case the laboratory and wards chosen were in the same hospital and in the other, although they were in different hospitals, the distance separating them was only about 500 yards. During the trials the hospitals' messenger services continued to deliver requests and specimens from the wards to the laboratories and to return completed reports to the wards in the usual way. Before they were returned by messenger, however, copies of the reports were transmitted from the laboratories to the wards by F/T equipment. This was done in both trials by connecting a transmitter installed in the pathology laboratory to a receiver at the nurses' station on one of the two wards selected. Facsimile copies of reports for the other wards in the trials were delivered by nursing staff as soon after receipt at the nurses' stations as possible. Although equipment providing the highest possible transmission speed was not used for the trials, this had no appreciable effect on the results because the number of reports involved was not large enough to make transmission time a significant factor. The times the request and report forms (both copies) reached the various stages in their progress from the wards to the laboratories and back again were recorded to provide the following information.

(1) To what extent and how much sooner copies of reports transmitted by F/T equipment reached the wards before those delivered by messenger.
(2) The extent to which clinicians were present in the wards to take advantage of earlier delivery of reports by F/T transmission.
(3) The times taken for the several main stages in the progress of request/report forms.

In addition clinicians were asked to classify the action taken on all reports under one of six agreed headings, so that in those cases where they found it possible to take earlier action on the copies transmitted by F/T, they could assess the effect on patients' treatment.

Aims of trials

26. The trials were designed to determine:

(1) The extent to which the use of F/T equipment in place of the hospitals' messenger services for transmitting pathology reports between the laboratories and wards, enabled clinicians to take earlier action on them and facilitated the notification of reports regarded as urgent.
(2) The advantages which clinicians found accrued to the patients when earlier action was taken.
(3) The ability of the present messenger services to provide the services required.
(4) The effect on the results produced by the trials if hourly messenger services had operated throughout in place of the existing services.

Results of trials

27. The principal results of the trials are summarised below:

(1) All F/T copies of reports reached the wards before those delivered by messenger.
(2) Only in 34·7% and 61·8% respectively of cases did this actually result in action being taken on F/T copies by the responsible clinicians before the arrival of the copies delivered by messenger.
(3) Had hourly messenger services operated during the trials in place of the less frequent services actually provided, these percentages would have been reduced to 16·2% and 4% respectively.
(4) The clinicians responsible reviewed the case notes of the small residue of patients represented by these percentages and eliminated those where they considered the action taken on the reports had

produced no identifiable benefits. This left final percentages of nought and 2·4 respectively in which the clinicians were able to show that some benefit had accrued to the patients concerned because earlier action on reports had been possible. In fact each of the three patients comprising the 2·4% was prescribed a change of drug but only in one case was it actually given on the same day as it was prescribed.

(5) The number of pathology reports requiring urgent notification to wards was comparatively small, usually between 1% and 5% of the total dispatched. Although F/T transmission was faster than messenger delivery it was marginally slower than telephone communication which was the method used to notify the results of urgent reports to wards at the hospitals visited. Results of urgent tests were always given to a clinician or qualified nurse and the usual written reports followed later. These arrangements appeared to meet the requirements adequately.

(6) Expediting the return of reports by using F/T transmission in place of an hourly messenger service would only shorten by minutes one stage in the progress of request of report forms from wards to laboratory and back again; a procedure which occupies altogether at least a number of hours but has generally to be measured in days.

(7) The time taken for F/T transmission could produce delays if there were large numbers of reports to be sent and batching of completed reports occurred.

Factors affecting the choice of F/T for pathology report transmission in district hospitals

28. Transmission time by F/T was not a significant factor in the trials because of the small number of reports involved. However, if F/T equipment were used, for example, in a district general hospital of 20 wards where an average of 175 in-patient requests were received each week-day, this factor would assume far greater importance. If each report was one-third foolscap size, the total week-day transmission time using the highest speed equipment available would be about 3 hours 45 minutes which includes an allowance of 20 minutes for loading and unloading the transmitter. Unless a reasonably smooth flow of completed reports could be achieved—not an easily attainable pattern in pathology laboratories—even the small time advantages revealed by the trials could be lost, resulting in F/T copies reaching the wards after the delivery times an hourly messenger service could achieve. Delay due to transmission time could, of course, be reduced by providing an additional transmitter in the laboratory.

29. On the other hand, in any routine messenger round-trip service there is an inherent delay which is very small for the first point visited but increases progressively as a round proceeds. Delays from this cause can be reduced by arranging for the points in the round to be visited in an optimum order.

30. The total annual revenue cost of completely equipping a pathology laboratory and 20 wards with F/T equipment for the transmission and reception respectively of pathology reports would be about £2,847. The addition of a second transmitter in the laboratory would increase this cost by about £141. Sharing one receiver between two wards, assuming the hospital layout made such an arrangement feasible, would reduce the cost to about £1,568 per annum. The cost of a special messenger service to link laboratory and wards in a hospital of this size and providing, say, nine hourly deliveries between 9 a.m. and 5 p.m. on week-days and four between 9 a.m. and noon on Saturdays would be about £883 per annum. This assumes a time allowance of 2½ minutes for each point visited which is based on timings taken during the trials, and an annual cost of £824 for a full-time Class 1 porter. The computation of the costs quoted in this paragraph is set out in Appendix C.

31. Direct comparison between the cost of F/T equipment and a special messenger service for the return of pathology reports to wards is not generally valid because it assumes that a separate service would be provided for this purpose, whereas in practice this would normally be one of the functions of a comprehensive routine service covering all wards and departments. Where a messenger service on these lines was operating, no appreciable saving on its cost could be expected to follow the introduction of F/T transmission of pathology reports unless it enabled a significant reduction to be made in the number of ward visits made. Any savings achieved would inevitably be small in comparison with the cost of providing F/T equipment and appreciably less than the cost quoted in paragraph 30 for a separate messenger service.

32. Apart from providing for the transmission of pathology reports to wards, the use of F/T equipment would enable the originals to be retained as the laboratory copies so that existing procedure for obtaining duplicates could be dispensed with. Either photocopying, interleaved carbon or NCR paper (No Carbon Required) are methods commonly employed at present for this purpose. The use of interleaved carbon or NCR paper has the advantage that the preparation of duplicate copies as a separate process is eliminated and reports are available for distribution to wards immediately after signature by the pathologist. With photocopying, reports are duplicated after signature by the pathologist, so that distribution is inevitably delayed by the time taken for this process. The time taken daily to copy an average of 175 reports using Xerographic equipment, including the ancillary tasks of preparation, guillotining and clearing away, would be about 28 minutes.* The annual cost of reproducing this number of reports by Xerography would be about £275 and this sum would be saved if F/T equipment was introduced at a hospital using this method of duplication. Corresponding but smaller savings would be made where interleaved carbon or NCR paper was in use.

*Abstract of Efficiency Studies in the Hospital Service No. 72: Pathology Department (H.M.S.O., price 8d. each).

Conclusions as to suitability

33. The trials have shown that the use of F/T equipment in place of an effective messenger service for the return of pathology reports to the wards, although costing substantially more, provides no more than a tenuous benefit to patients. The transmission time factor could eliminate the small benefits identified during the trials and, if used in a laboratory handling a substantial number of reports, could result in slower rather than quicker reporting to wards in some cases. The small and rather uncertain advantages accruing do not appear sufficient to justify the additional expense of providing F/T equipment for pathology report transmission between the laboratory and wards in a district general hospital. This conclusion can be expected to apply equally to all other types of hospitals.

APPENDIX A

(paragraph 20)

The principal internal document movements in two hospitals of the district general hospital type and considerations affecting the introduction of F/T transmission in place of existing methods

Principal statistics affecting the volume of document movement

	Hospital A	*Hospital B*
Bed complement	618	978
Beds staffed and available	592	901
Number of wards	21	32
Out-patient attendances, 1964	105,716	94,092
Casualty attendances, 1964	33,064	24,415

Note 1: In all cases transmission by F/T equipment would cost substantially more than messenger delivery. An example of this appears in Appendix B in which the principal document movement between wards and departments is costed for the two methods of transmission.

Document	*Approximate number used weekly*		*Present movement arrangements for document*		*Considerations affecting the introduction of F/T equipment in place of the present transmission arrangements* (*Note* 1)
	Hospital A	*Hospital B*	*Hospital A*	*Hospital B*	
Pathology requests/reports	865 (in-patient)	1,040 (in-patient)	*In-patient* requests accompanied by the required specimens are conveyed between the wards and the pathology laboratory by messenger and completed reports, other than those regarded as urgent, are returned in the same way. Urgent reports are normally notified to clinicians or qualified nurses on the wards by telephone and the actual reports taken later by messenger. A similar procedure applies to requests emanating from the operating theatre. Only a very few of these need to be treated as urgent so that most of the reports arising from this source are returned to the wards by messenger in the usual way. The results of the tests carried out urgently are normally notified to the surgeons in the theatre by telephone.		No advantage would accrue from using F/T equipment to transmit requests from wards to the laboratory because no action can be taken there before the specimens arrive. If, as seems likely, a prompter delivery of reports to wards is possible with this equipment than with a messenger service, it could enable clinicians to take earlier action on reports which might, in turn, benefit the patients concerned. Using this equipment to notify urgent reports to wards and theatres would be marginally slower than telephone, but would provide the clinicians with facsimile copies which might be considered less liable to misinterpretation. In fact, the hospitals visited were apparently satisfied with notification by telephone providing the safeguard that reports should only be notified to a clinician or qualified nurse was observed. Even if F/T were used it would be desirable to tell the ward or theatre staff by telephone when an urgent report was to be transmitted in case there was nobody near the F/T receiver at the time.
	765 (out-patient)	300 (out-patient)	*Out-patient* requests are normally taken to the laboratory by the patients concerned. The required specimens are either taken at the time or appointments are given if they are to be taken later. Completed reports are taken in batches to the out-patient department by messenger in time for the patients' next clinic attendance.		Again as no action can be taken in the laboratory before the specimens are taken, F/T transmission of requests from the out-patient department would serve no useful purpose. Messenger delivery at the hospitals visited adequately met the requirement that completed reports should be available in time for patients' next clinic attendances and no advantage would accrue from earlier delivery by F/T.

X-ray requests/reports	135 (in-patient)	185 (in-patient)	*In-patient* requests are taken from the wards to the X-ray department by messenger. The patients themselves are subsequently fetched from the wards by portering staff at the times required by the department.		Using this equipment to notify ward requests would provide the X-ray department with an earlier indication of this part of their work commitment which might facilitate marginally the planning of the department's activities. It would be unlikely to expedite the examination of patients to any significant extent. The practice followed by Hospital A of returning X-ray plates with reports is the one generally followed. Where it obtains no advantage would accrue from the earlier return of reports by F/T because they would not normally be considered before the arrival of the X-ray plates which would have to be delivered by messenger in any case.
			Completed reports and the relative X-ray plates are taken to the wards by messenger.	Only completed reports are taken to the wards in the first instance. The relative plates are taken later if requested.	
	416 (out-patient)	280 (out-patient)	*Out-patient* requests are taken to the X-ray department either by the patients concerned or by an accompanying porter. The examination is either carried out at the time or an appointment is given. Completed reports and the relative X-ray plates are returned to the out-patients' department in batches by messenger in time for the patients' next clinic attendances.	The same procedure is followed except that requests for the types of examination which are done by appointment are delivered in batches to the X-ray department by messenger and appointments are notified to patients by post.	F/T transmission of requests would provide no advantage in this application because normally no profitable action can be taken in the X-ray department before the arrival of the patients. Earlier notification of appointment cases by F/T to the department at Hospital B would be unlikely to have any significant effect on the notification of appointments by post. Messenger delivery at the hospitals visited adequately met the requirement that reports and plates should be available for the patients' next clinic attendances and no advantage would accrue from earlier delivery of reports by F/T.
	252 (accident and emergency)	75 (accident and emergency)	*Accident and emergency* department requests are taken to the X-ray department either by the patients concerned or by an accompanying porter. The reports and wet films, or the latter only if a radiologist is not on duty, are returned to the casualty officer by messenger as a matter of urgency.		Again nothing would be gained by using F/T to transmit requests to the X-ray department because no profitable action can be taken before the arrival of the patients. In these cases where reports are provided, no advantage would result from their earlier return by F/T because they would not normally be examined by the casualty officer in the absence of the wet films, which would have to be returned by messenger.
Prescription cards	300 (in-patient)	500 (in-patient)	*In-patient* prescription cards for drugs which are not available from ward stocks are taken by messenger to the pharmacy for dispensing. Cards are either conveyed in the ward dispensary boxes, which are returned daily to the pharmacy for the issue of bulk drug stocks to wards, or are taken as they become available during the day. The cards are returned to the wards with the dispensed prescriptions by messenger either in the boxes with the daily bulk issues, if ready at the time, or separately. The few prescriptions required urgently are normally collected by ward staff who take the prescription cards and wait while the drugs are dispensed.		The majority of in-patient prescriptions can normally be met from ward stocks and only a residue of cards need to be sent to the pharmacy. Using F/T for this purpose would result in prescriptions reaching the pharmacy before the times a messenger service can achieve, although assuming an effective service the time saved using F/T would normally only be measured in minutes. An earlier return of the prescriptions to the wards would only be achieved if the work arrangements in the pharmacy enabled dispensing to take place correspondingly sooner, so that they could be taken by an earlier messenger collection. Even where this was possible it might not result in significantly earlier treatment of patients because prescriptions delivered by the wholly manual method could be expected either to arrive in time for the same medicine round or shortly enough after for the drugs to be given immediately, if this was considered preferable to waiting until the next round. Prescriptions required urgently for patients and not available from ward stocks necessitate an immediate return journey between ward and pharmacy. The use of F/T would neither affect this requirement nor hasten their procurement.

APPENDIX A (contd.)

Document	*Approximate number used weekly*		*Present movement arrangements for document*		*Considerations affecting the introduction of F/T equipment in place of the present transmission arrangements* (*Note* 1)
	Hospital A	*Hospital B*	*Hospital A*	*Hospital B*	
Prescription cards (*contd.*)	1,200 (out-patient)	235 (out-patient)	*Out-patient* prescription cards are generally taken to the pharmacy by the patients concerned, although occasionally a companion or messenger from the out-patient department may do so. The usual practice is to wait and collect the prescriptions on the same visit. The prescription cards are retained by the pharmacy and returned in batches to the medical records department by messenger for return to the patient's case notes.		Using F/T in this application would provide no advantage apart, possibly, from producing a marginal reduction in out-patients' waiting-time at the pharmacy. The requirement that the prescription cards should be filed away in the patients' case notes before their next clinic attendances was being adequately met by messenger delivery at the hospitals visited and no advantages would accrue from their earlier return to the medical records department by F/T.
Physiotherapy requests	40 (in-patient)	35 (in-patient)	*In-patient* requests are taken by messenger from the wards to the physiotherapy department where the necessary treatments are arranged. These are given either in the wards or the department. When treatment has been completed, requests are returned by messenger to the medical records department for filing in the patients' case notes.		The movement of physiotherapy requests between wards, the physiotherapy department and medical records department is not normally so urgent that the earlier delivery to be expected by using F/T in place of an effective messenger service would have any significance. At the hospitals visited messenger delivery adequately met the normal requirements and if, exceptionally, treatment for a patient was required urgently this was arranged by telephone.
	90 (out-patient)	65 (out-patient)	*Out-patient* requests are generally taken to the physiotherapy department either by the patients concerned or by a companion. The necessary appointments are made and treatment given. When treatment has been completed or at any stage during treatment should the consultant require it, the requests are returned by messenger to the out-patient department and filed in the case notes to be available for the patient's next clinic attendances.		Earlier delivery of the requests to the physiotherapy department by F/T would provide no significant advantage because the fixing of appointments would have to await the arrival of the patients or their companions in any case. Messenger delivery at the hospitals visited adequately met the requirement that requests should be available in the case notes for patients' next clinic attendances and no useful purpose would be served by their earlier return by F/T.
In-patients admission forms	210	245	*Admission forms* are prepared in quintuplicate either in the reception, maternity or psychiatric unit for all patients admitted. In each case one copy is filed with the case notes which accompany the patient to the ward, another copy is sent by messenger to the telephonists and the other three are sent daily by messenger in a batch to the medical records department. One copy of each admission form is retained in this department and the other two are taken by messenger to the general office and the Medical Social Worker's department respectively, again in daily batches.	*Admission forms* are prepared in duplicate in the reception unit for each patient admitted. One copy is filed with the case notes which accompany the patient to the ward and the duplicate copies are sent daily by messenger in a batch to the medical records department. The telephonists obtain the information they require concerning admissions from the reception unit by direct enquiry. The Medical Social Worker whose office adjoins the medical records department, borrows this department's copies of the admission forms daily to extract the information she requires.	At neither hospital was more urgent movement of the admission forms required than the messenger services provided and therefore nothing would be gained from transmission by F/T. In fact, as the forms were generally moved in batches, F/T transmission might even be slower than messenger delivery on occasions because of the transmission time factor.

Patients' transport requests	170 (in-patient)	70 (in-patient)	*In-patient* transport request cards are taken by messenger from the wards to the general office. Here they are accumulated and passed in batches to the transport office, again by messenger, usually three times each week-day and once on Saturdays. When transport is required too urgently for this procedure to be followed, the usual practice is for ward staff to telephone their requirements direct to the Transport Officer who constructs a "dummy" request card at the time for record purposes. The Transport Officer notifies the transport requirements to the local ambulance services and the hospital car service either on prescribed forms which are posted, by telephone or by direct oral communication with drivers.	*In-patient* transport requirements are normally telephoned by the ward staff to the Transport Officer who compiles a record of all requests notified. Subsequently he makes the necessary arrangements with the local ambulance services either by submitting details of the transport required on prescribed forms which are posted or by telephoning when there is insufficient time for postal communication.	The procedures for notifying the urgent and routine external transport requirements for in-patients and out-patients to the Transport Officers of the hospitals visited enabled the necessary arrangements to be satisfactorily made with the responsible authorities. No significant improvement in these arrangements could be expected by using F/T which would: (1) speed up delivery of routine requests at present delivered by messenger service, although to no useful purpose because the present methods are prompt enough; (2) slow down marginally the delivery of requests at present notified by telephone which includes all those regarded as urgent. In urgent cases, too, the fact that the requisitioning officer would not know if the F/T receiver was staffed at the time of transmission would be a further disadvantage of communicating in this way. Consideration of the desirability of introducing F/T for the transmission of transport requests between hospitals and ambulance stations was outside the scope of this study. It should be mentioned, however, that a local health authority has under review the possibility of introducing a F/T link for this purpose at one particular location. Although the authority concerned may well have grounds for believing that this would be advantageous to them in the particular application for which they are considering it, in general it seems unlikely that such arrangements would be more favourable to hospitals than communication by post and telephone.
	550 (out-patient)	400 (out-patient)	*Out-patient* transport request cards for patients' first attendances are raised by the Transport Officer from the appointments forms. The practice is for a clerk in the out-patient department to sort appointments forms on which transport is shown to be required into separate batches. These batches are collected at intervals during the day by the Transport Officer whose office is in the out-patient department, for the necessary action to be taken before they are posted to the patients. Transport request cards for out-patients requiring transport for second and subsequent attendances are completed by nursing staff in the clinics and taken to the Transport Officer either by the patient concerned, by a companion or by messenger. The methods of communication used between the Transport Officer and the transport services in the case of in-patients applies equally to out-patients.	*Out-patients* requiring transport for their first attendances have it arranged by an appointments clerk who telephones their requirements to the Transport Officer. Those requiring transport for second and subsequent attendances are given a transport request signed by their clinician which they take to the Transport Officer, although a companion or hospital messenger may do so on occasions.	

APPENDIX A (contd.)

Document	*Approximate number used weekly*		*Present movement arrangements for document*		*Considerations affecting the introduction of F/T equipment in place of the present transmission arrangements* (*Note* 1)
	Hospital A	*Hospital B*	*Hospital A*	*Hospital B*	
Prescriptions for patients' appliances	50 (in-patient) 150 (out-patient)	80 (in-patient and out-patient numbers combined —separate figures not available)	*In-patient* prescriptions are written on a prescribed form which is taken by messenger to the general office for the necessary order to be compiled and despatched by post to the contractor. No copy orders are circulated within the hospital. *Out-patient* prescriptions are normally taken to the general office by the patients themselves. In all other respects the procedure is the same as for in-patients.	*In-patient and out-patient* prescriptions are written up in the patients' case notes which are taken to the general office by messenger where the ordering arrangements are similar to those outlined for Hospital A.	In the case of Hospital A the use of F/T should result in prescriptions reaching the general office ahead of the time the messenger service or patients can achieve. Assuming a regular messenger service the time saved would be a very small factor of the total time normally required for the ordering and supply of appliances and no significant advantage could be expected from its use. In the case of Hospital B it might not be feasible to transmit extracts from case notes by F/T but, even if it were, or if a separate prescription form were introduced, the comments made regarding Hospital A would equally apply.
Works requisitions	175	210	*Works requisitions* are compiled in the wards and departments and are forwarded by messenger to the general office. After vetting they are sent in batches, again by messenger, to the Engineer's department (or to the Building Supervisor's department in the case of Hospital A) for the necessary work to be put in hand. Urgent requisitions are channelled the same way but are normally telephoned.		The faster transmission of requisitions possible with F/T than by messenger service could result in earlier action being taken on them by the Engineer's or Building Supervisor's departments depending on their other work commitments at the time. Any small savings in the time achieved, however, would not be particularly significant because only routine requisitions which need not be met as a matter of urgency would normally be sent by messenger. The present practice of notifying urgent requirements by telephone is preferable to using F/T because it is marginally faster, it provides the caller with an immediate assurance that the message has been received and gives the person replying an opportunity to elicit any additional information that may be required.
Provisions requisitions (or daily diet sheets)	150	220	*Provisions requisitions* (single copy) are compiled in the wards and in a few departments, and are forwarded daily by messenger to the catering department. After authorisation they are passed in daily batches to the stores nearby, again by messenger, for the issues to be made. The delivery porters take the requisitions with them on their rounds of the wards and departments to obtain a discharge at each delivery point. The discharged requisitions are returned to the Head Porter who returns them in daily batches to the finance department for ledger posting purposes.	The provisions requisitioning and issuing procedure at this hospital is similar to the one described for Hospital A. The principal difference lies in the fact that the individual requisitions are retained in the catering department where they are used to prepare a daily summary issue sheet which is used for obtaining discharges and for ledger posting purposes.	At both hospitals there was a daily routine procedure for dealing with the requisitioning and issuing of provisions, relying on messenger delivery at all stages, which enabled issues to be made by the required time. Earlier delivery of requisitions from the wards and departments to the catering department, such as F/T could provide, would offer no advantages. It is also desirable both from the point of view of economy and control for the individual or summary requisition vouchers to be taken by the porter to the wards and departments at the same time as the stores delivery is made and not to be transmitted separately.

Ward diet summary (only applicable in hospitals where patients are allowed a choice of dishes)	147	Not applicable	*A ward diet summary sheet* is compiled daily in each ward and forwarded by messenger to the catering department. Here the entries on the individual ward sheets are transcribed on to a daily summary for the hospital, which is taken by hand to the kitchen situated nearby.	Not applicable.	The routine procedure at Hospital A for dealing with the diet summary sheets which included messenger delivery between the wards and the catering department, enabled the necessary information to be made available to the kitchen by the required time. No advantages would accrue from earlier delivery by F/T.
Clock cards	950	800	*Clock cards* are normally taken by messenger in departmental batches between the time-clock, the salaries and wages section and the departments concerned. The usual arrangements for the certification of the cards and the computing of pay require that these weekly batches should make a double return journey between the latter two locations.	*Clock cards* are collected by the individual departmental heads from the time-clock at the main gate of the hospital in weekly batches. They retain the clock cards in their departments and prepare from them a summary of hours worked by their staff which they certify. These summaries are taken by messenger to the salaries and wages section.	The routine procedures for dealing with clock cards at the two hospitals visited provided the salaries and wages sections with the variable information necessary to compute the pay of the employees concerned at the time it was required. Earlier transference of the cards by F/T would offer no advantages although in any case, because of the comparatively large size of some of the batches, it could result in slower rather than quicker movement because of the transmission time factor.

APPENDIX B

(paragraph 22)

Comparative costs of F/T transmission and messenger delivery of the single-sheet documents most frequently transmitted, between 20 wards and departments in a district general hospital of 600 beds

The studies showed that the following eight documents were transmitted by wards in the largest numbers (see Appendix A). The approximate annual transmission rates revealed by the studies are shown in each case and, where appropriate, these have been used as the basis for costing. Pathology requests have been excluded because, as they invariably accompany specimens which require messenger or some form of mechanical delivery, it would be purposeless to send them separately by F/T.

X-ray requests (to X-ray departments) ..	10,000
Prescriptions (to pharmacy)	20,000
Physiotherapy requests (to physiotherapy department)	2,000
Transport requests (to transport section) ..	7,500
Prescriptions for patients' appliances (to appliance officer)	2,500
Works requisitions (to general office) ..	10,000
Provisions requisitions (to catering department)	7,500
Ward diet summaries (to catering department)	7,500
Total transmitted by wards to seven different locations	67,000

F/T transmission (by prepared document transmission equipment)*

Note 1. An amortising period of 10 years has been used to convert the capital cost of the installation to an annual revenue charge. This period was agreed with the manufacturer to represent a reasonable life expectancy for the equipment.

Note 2. Estimate based on information provided by the manufacturer.

Note 3. Estimate based on information provided by the Engineering Branch of the Ministry of Health. This charge would be saved if the internal telephone lines of a hospital were utilised.

Note 4. Estimated costs based on forms all being one-third foolscap size.

Capital cost of installation

Equipment	£
Twenty transmitters (one to each ward) at £898 each	17,960
Seven receivers (one to each location) at £756 each	5,292
Switching gear (estimated) (Note 2)	675
Wiring (estimated) (Note 3)	405
Total capital cost ..	24,332

Revenue cost per annum

	£
Amortisation of capital cost (Note 1) ..	2,433
Interest at 5½% (in 1964) on 50% of capital cost	669
Maintenance agreement (estimated) (Note 2)	710
Paper for receivers (Note 4)	179
Receiver marking blades (Note 4)	9
Fuel costs (estimated) (Notes 2 and 4) ..	18
Total annual revenue cost ..	4,018

Messenger delivery

It is assumed that collections from the wards are required at hourly intervals from 9 a.m. until 5 p.m. each week-day and until noon on Saturdays, which represents 49 rounds weekly. On the basis of timings taken during the trials it is estimated that an average of 2½ minutes would be required for each point visited, so that each round of 27 points would take 67½ minutes.

Total weekly messenger time (49 × 67½ minutes) 55 hours 7½ minutes	
Cost of a full-time porter, Class 1, based on London rates†	£824
Total annual revenue cost of messenger service	£1,136

* The costing has been based on the use of F/T equipment designed for prepared document transmission because although equipment for manuscript communication could be used if suitably preprinted stationery were provided, it would involve supplying eight different types of continuous stationery to each ward transmitter—one for each document to be transmitted—and this stationery would have to be changed each time there was a change in the type of document to be transmitted. This would make its use rather impractical and certainly much less convenient than prepared document transmission equipment.

† Cost for a 40-hour working week including employers' contributions in respect of superannuation, N.H.I. and Graduated Pension Scheme, plus an addition of 8% for sickness and annual leave replacements.

APPENDIX C

(paragraph 30)

Comparative costs of F/T transmission and messenger delivery of pathology reports between the laboratory and 20 wards in a district general hospital of 600 beds

F/T transmission (by prepared document transmission equipment)*

Note 1. An amortising period of 10 years has been used to convert the capital cost of the installation to an annual revenue charge. This period was agreed with the manufacturer to represent a reasonable life expectancy for the equipment.

Note 2. Estimate based on information provided by the manufacturer.

Note 3. Estimate based on information provided by the Engineering Branch of the Ministry of Health. This charge would be saved if the internal telephone lines of a hospital were utilised.

Note 4. Estimated costs based on 50,000 in-patient reports per annum.

Capital costs of installations

Equipment	1 *transmitter and* 20 *receivers* (£)	2 *transmitters and* 20 *receivers* (£)	1 *transmitter and* 10 *receivers* (£)
Transmitter(s) at £898 each	898	1,796	898
Receivers at £756 each	15,120	15,120	7,560
Switching gear (estimated) (Note 2)	500	500	250
Wiring (estimated) (Note 3)	300	300	150
Total capital costs ..	16,818	17,716	8,858

Revenue costs per annum

Amortisation of capital cost (Note 1)	1,681	1,771	886
Interest at 5½% (in 1964) on 50% of capital cost	462	487	244
Maintenance agreement (estimated) (Note 2)	550	575	290
Paper for receivers (Note 4)	133	133	133
Receiver marking blades (Note 4)	7	7	7
Fuel costs (estimated) (Notes 2 and 4)	14	15	8
Total annual revenue costs ..	2,847	2,988	1,568

Messenger delivery

It is assumed that deliveries are required at hourly intervals from 9 a.m. until 5 p.m. each weekday and until noon on Saturdays, which represents 49 rounds weekly. On the basis of timings taken during the trials it is estimated that an average of 2½ minutes would be required for each point visited, so that each round of 21 points would take 52½ minutes.

Total weekly messenger time (49 × 52½ minutes) 42 hours 52½ minutes

Cost of a full-time porter, Class 1, based on London rates† £824

Total annual revenue cost of messenger service £883

* F/T equipment designed for manuscript communication and using suitably preprinted stationery could be used if (1) it was not a requirement that a two-part request/report form originated on the ward should be used, and (2) it was convenient for reports to be compiled and signed individually on the continuous stationery in the transmitter(s) in the pathology laboratory. The use of this type of equipment could be expected to reduce the total annual revenue costs shown above by about 25%.

† Cost for a 40-hour working week including employers' contributions in respect of superannuation, N.H.I. and Graduated Pension Scheme, plus an addition of 8% for sickness and annual leave replacements.

Ministry of Health

The following titles in this series have been issued:

Hospital Technical Memorandum

1. Anti-static precautions: rubber, plastics and fabrics	1*s* 0*d*	(1*s* 3*d*)
2. Anti-static precautions: flooring in anaesthetising areas	1*s* 3*d*	(1*s* 8*d*)
3. Fire precautions: fish fryers	1*s* 0*d*	(1*s* 3*d*)
4. Colour code of flexible cables and cords	6*d*	(9*d*)
5. Steam boiler plant instrumentation	1*s* 6*d*	(1*s* 9*d*)
6. Protection of condensate systems: filming amines	6*d*	(9*d*)
7. Electrical services—supply and distribution	7*s* 6*d*	(8*s* 1*d*)
8. Safety code for electro-medical apparatus	3*s* 6*d*	(3*s* 11*d*)
9. Pneumatic tube communications systems	1*s* 6*d*	(1*s* 11*d*)
10. Pressure steam sterilisers	3*s* 0*d*	(3*s* 5*d*)
11. Emergency electrical services	5*s* 0*d*	(5*s* 6*d*)
12. Maintenance of buildings, plant and equipment	3*s* 0*d*	(3*s* 5*d*)
13. Planned preventive maintenance: a system for engineering plant and services	6*s* 0*d*	(6*s* 7*d*)
14. Abatement of electrical interference	4*s* 0*d*	(4*s* 5*d*)
15. Patient/Nurse call systems	4*s* 6*d*	(5*s* 0*d*)
16. Fire precautions	4*s* 6*d*	(5*s* 0*d*)

Price including postage shown in brackets

Binders for this series of Notes are available from H.M. Stationery Office, price 6*s* 0*d* net (6*s* 10*d*)

Ministry of Health hospital guidance publications include: Hospital Building Notes; Equipment Notes; Design Notes; Building Bulletins and Technical Memoranda

Printed in England for Her Majesty's Stationery Office by The Campfield Press, St. Albans

Dd. 132448. K.48. 4/67,

S f B (94) : (64)

UDC 725.51 : 621.394

© *Crown copyright* 1967

Published by
HER MAJESTY'S STATIONERY OFFICE

To be purchased from
49 High Holborn, London W.C.1
423 Oxford Street, London W.1
13A Castle Street, Edinburgh 2
109 St. Mary Street, Cardiff
Brazennose Street, Manchester 2
50 Fairfax Street, Bristol 1
35 Smallbrook, Ringway, Birmingham 5
7-11 Linenhall Street, Belfast 2
or through any bookseller

S.O. Code No. 32-509-18